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A RESEARCH MODEL TO UNDERSTAND THE IMPACT OF ENTERPRISE SYSTEMS ON MANAGEMENT ACCOUNTING

Nikolaos Vakalfotis
Alexander Technological Educational Institute,, vakalfotis@gmail.com

Joan Ballantine
University of Ulster, joan.ballantine@ulster.ac.uk

Anthony Wall
University of Ulster, ap.wall@ulster.ac.uk

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Vakalfotis, Nikolaos, Alexander Technological Educational Institute, Thessaloniki, 57400 – Sindos, Greece, vakalfotis@gmail.com
Ballantine, Joan, University of Ulster, Department of Accounting, Jordanstown Campus, Shore Road, U.K., joan.ballantine@ulster.ac.uk
Wall, Anthony, University of Ulster, Department of Accounting, Jordanstown Campus, Shore Road, U.K., ap.wall@ulster.ac.uk

Abstract

Firms worldwide have recently made substantial investments in implementing enterprise systems such as enterprise resource planning (ERP) systems and business intelligence (BI) systems. The deployment of both can have important implications for management accounting. Specifically, ERP systems have been shown to be a vehicle for transaction-orientated changes (e.g. benefits in respect of information processing), while BI systems are more likely to drive strategic-orientated changes (e.g. benefits in respect of information reporting and analysis).

Since the early 2000s, the relationship between enterprise systems and management accounting has constituted a research topic of particular interest, and there is a growing body of literature in this area. To date, researchers have focused on ERP systems, although one study has also investigated the impact of BI systems. Despite the fact that considerable research has been devoted to examining the impact that ERP systems have upon both management accounting practice and the role of the management accountant, no clear conclusions on these issues can be drawn. This can possibly be explained by the fact that, to date, most research has tended to focus on describing what changes in management accounting have resulted from the implementation of enterprise systems rather than focus on analysing and understanding that change.

To this end, a conceptual model of causal relationships is developed and proposed for empirical testing to better understand the relationship between enterprise systems and management accounting. The technology acceptance model and flow theory represent the heart of the research model. The model has been enriched with a number of external variables which have been identified from an extensive review of previous empirical research at the interface of enterprise systems and management accounting. All of the variables identified represent issues which are directly or indirectly related to the implementation and use of enterprise systems. To date, insights regarding these variables and the influence they exert on the extent of change in management accounting practice and in the role of the management accountant resulting from the implementation of enterprise systems have mainly been gained from case study research which have not facilitated well-grounded generalisations among organisations to be made. This research addresses this limitation in the literature.

Keywords: Enterprise systems, ERP, Business intelligence, Management accounting, Management accountant.

1. INTRODUCTION

In recent years, the contribution of management accounting to business control and planning has increased considerably as a result of a global highly competitive business environment. Enterprise systems (ES), one of the latest advancements in the corporate use of information systems (IS), appear to have the potential to enhance this contribution (see, for example, Nicolaou, 2008; Kallunki et al., 2011). The term ES is widely used in the literature (see, for example, Davenport, 1998; Shang and Seddon, 2002; Schubert and William, 2009), and refers to business IS that are implemented in order to integrate information flows across entire organisations. Enterprise resource planning (ERP) systems, the primary ES form (Sutton, 2006), are intended to integrate a number of functional areas such as finance, cost, sales, materials management, production planning, quality management, plant maintenance, service management, and human resources (Sadagopan, 2003). To attain information integration, ERP systems exploit a centralised database which collects and stores data within the organisation in real-time. Interestingly, ERP systems have recently seen a new type of ES emerge as a strategic offspring, namely business intelligence (BI) systems. BI systems normally sit on top of ERP systems, and are intended to combine transactional efficiency with strategic planning (see, for example, the BI solutions offered by Epicor, IBM Cognos, Microsoft Dynamics, Oracle, and SAP). More precisely, BI systems are implemented to support strategic decision-making (Bucher et al., 2009; Mikroyannidis and Theodoulidis, 2010) by providing managers with insights into their business operations (Seah et al., 2010). BI systems are generally composed of three complementary and interrelated tools, namely data warehousing, online analytical processing (OLAP) and data mining. As Teorey et al. (2006) describe, data warehousing deals with the storage, maintenance and retrieval of historical data; OLAP provides quick answers to *ad hoc* queries; and data mining is a collection of algorithms which find patterns in the data and return valuable user information.

Since the early 2000s, there has been large scale adoption of ERP and BI systems due to their potential to boost firm performance (see Poston and Grabski, 2001; Hunton et al., 2003; Nicolaou et al., 2003; Nicolaou, 2004; Wieder et al., 2006; Wier et al., 2007; Elbashir et al., 2008; Kallunki et al., 2011). Unlike other types of ES (e.g. customer relationship management, supply chain management) which are not as relevant to accounting, ERP and BI systems are closely associated with it. Explicitly, their operational scope encompasses several accounting processes, although such systems are typically designed and introduced by non-accountants (Chapman, 2005). These processes include general ledger, accounts receivable, accounts payable, financial control, asset management, funds flow, cost centers, profit centers, profitability analysis, order and project accounting, product cost accounting, and performance analysis (Sadagopan, 2003). BI systems incorporate all or part of these processes in a more sophisticated way (see, for example, Oracle Financial Analytics, www.oracle.com). Thus, both ERP and BI systems should have implications for all areas of accounting, namely management accounting, financial accounting, auditing and tax (Hunton, 2002; Sutton, 2006). From a management accounting perspective, ERP systems appear to be a vehicle for transaction-orientated changes (e.g. benefits in respect of information processing), while BI systems are more likely to drive strategic-orientated changes (e.g. benefits in respect of information reporting and analysis). At a general level, benefits in respect of information processing include generation of more comprehensive and reliable accounting information and increased flexibility in its gathering and provision, while benefits in respect of information reporting and analysis include generation of advanced reports (e.g. cost reports), elimination of the time-consuming use of spreadsheets, and utilisation of sophisticated accounting techniques (e.g. activity based costing, balanced scorecard, benchmarking, enterprise value added). Overall, these benefits enable quicker and more effective decision-making.

Given the potential of ES to improve the way management accounting tasks are performed, to advance management accounting practices, and, in the long run, to improve control and planning within the organisation, the relationship between these systems and management accounting has recently constituted a research topic of particular interest. As a result, there is a growing body of literature in

this area. To date, researchers have mainly shown interest in ERP systems, with the exception of Rom and Rohde (2006) who also investigated BI systems. Despite the fact that considerable research has been devoted to the impact that ERP systems have upon both management accounting practice and the role of the management accountant, no clear conclusions on these issues can be drawn. This is due to the fact that, up to now, most research has tended to focus on describing changes in management accounting resulting from ES implementations rather than focus on analysing and understanding them. In other words, whilst researchers have indicated how ES may have an impact on management accounting practice and on the management accountant's role, they have largely neglected to consider the explanatory variables of these impacts. These variables exert influence on the extent of change in management accounting practice and in the management accountant's role resulting from ES implementations. More specifically, looking at the extant relevant empirical findings, there are a number of companies which have experienced minor changes in management accounting post ERP implementations (e.g. some benefits in respect of information processing only), several which have experienced moderate changes (e.g. benefits in respect of information processing and few benefits in respect of information reporting and analysis), and a small number which have experienced significant changes (e.g. important benefits in respect of both information processing and reporting and analysis). Yet, no research has attempted to provide a sufficient explanation of why such differences among ERP adopting firms with regard to these changes exist. Indeed, it has been suggested that research on ES as it interrelates with management accounting is at an early stage of development (see Brignall and Ballantine, 2004; Arnold, 2006; Stefanou, 2006; Sutton, 2006; Berry et al., 2009; Granlund, 2011).

As a result, Sutton (2006) argues that the extant empirical findings in this area have been a poor guide to those interested in ES and management accounting. At the same time, it is increasingly important to understand the impact of ES on management accounting (Sutton, 2000, 2005, 2006; Granlund and Mouritsen, 2003; Rom and Rohde, 2006, 2007; Granlund, 2011) for the following two main reasons. Firstly, such systems appear to have the potential to facilitate practitioners' endeavors to advance management accounting practice in order to improve control and planning within their businesses; thus, practitioners (i.e. managers and management accountants) need to know whether and how these systems can meet expectations. Secondly, such systems drive semantic changes in the occupational identity of management accountants; thus, they need to know what skills they should add to their portfolio in order to respond to the demands of their new roles, and, in the long run, remain indispensable in their businesses.

The present study is an extension of the work of Vakalfotis et al. (2011) which provided an extensive review of previous empirical research within the area of ES and management accounting in order to identify gaps in the literature and provide directions for future research. Emerging from the above work, the present study develops and proposes for empirical testing a conceptual model of causal relationships that can help academics and practitioners to better understand the relationship between ES and management accounting. The proposed model is intended to address the following research questions, which have not been adequately examined in research to date.

- What explanatory variables influence the impact of ES on management accounting practice?
- What explanatory variables influence the impact of ES on the role of the management accountant?
- Whether, how, and, to what extent can ERP systems advance management accounting practice and the role of the management accountant?
- Whether, how, and, to what extent can BI systems advance management accounting practice and the role of the management accountant?

The remainder of this paper has been organised as follows. In the next section, an overview of the use of theory in existing ES-management accounting research is provided. This is followed with a discussion of the theoretical basis of the proposed research model. The research model is then

presented and the research hypotheses are identified. Finally, conclusions are drawn in the final section of the paper.

2. USE OF THEORY IN PRIOR ENTERPRISE SYSTEMS - MANAGEMENT ACCOUNTING RESEARCH

A literature search performed by Vakalfotis et al. (2011) revealed that, to date, a number of studies have examined the relationship between ES and management accounting. Table 1 provides a summary of these studies together with the research methods employed. The theoretical approach adopted by these studies in order to better understand the phenomena under investigation is also indicated in Table 1. As illustrated in Table 1, the use of theory in previous research at the interface of ES and management accounting is limited, given that less than one third of the studies listed have utilised a particular theoretical approach. Moreover, it can be seen that it is the interpretivist researchers (i.e. those who have adopted a case study method) who have tended to draw on theory rather than those which have adopted a positivist approach (i.e. those who have adopted a survey method). As a result, the majority of surveys undertaken to date are descriptive in nature, mainly describing changes in management accounting resulting from ES implementations rather than analysing and understanding them. In contrast, it seems that those studies, which have drawn on a particular theoretical approach (e.g. Caglio, 2003; Dechow and Mouritsen, 2005; Quattrone and Hopper, 2005; Kholeif et al., 2007; Jack and Kholeif, 2008), have provided more useful insights into the relationship between ES and management accounting. For example, Caglio (2003) and Jack and Kholeif (2008) adopted aspects of structuration theory to investigate their research issues in more depth. Specifically, Caglio (2003) found that the reason the changes driven by the implementation of the ERP system was primarily in favor of the accounting department was that the firm's accountants, through the chief financial officer, played the most influential role in all decisions around the implementation of the ERP system. Jack and Kholeif (2008) found that no positive changes in management accounting resulted from the implementation of the ERP system because the latter was very complex, and, as a consequence, unable to meet organisational needs. In a similar vein, Dechow and Mouritsen (2005) and Quattrone and Hopper (2005) adopted actor network theory to look behind the relationship of ERP systems and management accounting. The researchers found that although the ERP implementations in the case study firms were generally successful, only minor changes in management accounting occurred because of the immense complexity of the ERP systems implemented.

Table 1. Use of theory in ES-management accounting research to date

Study	Research Method	Theory
Booth et al., 2000	Survey	–
Granlund & Malmi, 2002	Case study	–
Caglio, 2003	Case study	Structuration theory
Hyvonen, 2003	Survey	–
Scapens & Jazayeri, 2003	Case study	–
Spathis & Constantinides, 2003	Survey	–
Doran & Walsh, 2004	Survey	–
Spathis & Constantinides, 2004	Survey	–
Dechow & Mouritsen, 2005	Case study	Actor network theory
Newman & Westrup, 2005	Survey & Case study	Technology power loop
Quattrone & Hopper, 2005	Case study	Actor network theory
Spathis & Ananiadis, 2005	Survey	Disconfirmation theory
Spraakman, 2005	Survey	–
Jackling & Spraakman, 2006	Survey	–
Rikhardsson & Kraemmergaard, 2006	Case study	Grounded theory
Rom & Rohde, 2006	Survey	–
Sayed, 2006	Case study	–
Spathis, 2006	Survey	–
Granlund, 2007	Case study	–

Kholeif et al., 2007	Case study	Institutional sociology theory
Jack & Kholeif, 2008	Case study	Strong structuration theory
O' Mahony & Doran, 2008	Case study	–
Colmenares, 2009	Case study	–
Grabski et al., 2009	Case study	–
Jean-Baptiste, 2009	Survey	–
Sangster et al., 2009	Survey	–

Although the studies outlined in Table 1 have increased our understanding of the relationship between ES and management accounting, it is not possible to generalise from the majority of this research as evidence has been collected only from a small number of organisations via the use of a case study method. In order to provide findings which are capable of greater generalisability, research methods such as surveys should be used (Arnold, 2006). Aspects of this argument are also recognised by Sutton (2006) who argues that "we [as a research community] really need to move to the next stage with the development of more generalized theories that help us to understand the phenomena in a more generalized fashion" (p. 3). In a similar vein, Granlund (2011), based on a critical review of research within the area of ES and management accounting, argues that there is a greater need to expand the use of theories in order to understand ES-related changes in management accounting. Responding to this, Vakalfotis et al. (2011) suggest that, in order to develop previous research in this area, we need to understand better under what conditions ES-related changes in management accounting take place and what the independent variables are in relation to this. Granlund (2011) suggests that academics and practitioners will better understand the relationship between ES and management accounting only if accounting researchers focus on issues surrounding the implementation and use of these systems. In line with Granlund's suggestion, the independent variables identified by Vakalfotis et al. (2011) represent issues which are directly or indirectly related to the implementation and use of ES (see section 4 of this paper for a discussion of the variables presented). Insights into these variables and the influence they exert on the extent of change in management accounting practice and in the management accountant's role resulting from ES implementations, have as already suggested mainly been gained thus far from studies which have adopted an interpretivist approach. Accordingly, positivist approaches (for example, surveys) are recommended to be used in order to examine such variables (Arnold, 2006) and to able generalisability of the findings. Additionally, responding to calls from others, accounting researchers should also draw on appropriate theoretical perspectives when adopting quantitative research methods in order to better understand and interpret the phenomena under investigation. An initial review the accounting literature highlights a number of theories might be appropriate for investigating the relationship between ES and management accounting, namely contingency theory, agency theory and transaction cost economics theory. However, Granlund (2011) argues that such theories "while providing some valuable insights into the area, they seem to push research into questions and problems that are many times far from the everyday practice of accountants…" (p. 6). A review of the IS literature has enabled the identification of two alternative theories, namely the technology acceptance model (TAM) and flow theory which are believed to be more suitable to the purposes of the proposed research. These theories will be described later in this paper. The adoption of a combination of both theoretical approaches will enable the researchers to investigate how the identified independent variables affect the behaviour of the management accountant toward the ES, and, subsequently, how the latter affects the extent of change in management accounting practice and in the role of the management accountant resulting from ES implementation.

3. THEORETICAL BASIS OF THE RESEARCH MODEL

Since its original conception by Davis (1986), the TAM has been systematically employed by researchers worldwide in order to predict or explain the usage of various types of technology such as e-banking (Lai and Honglei, 2005), e-commerce (McCloskey, 2003), e-learning (Gong et al., 2004),

the internet (Porter and Donthu, 2006), and mobile telecommunication (Wang et al., 2008). Given that the TAM is primarily orientated to IS research (Davis et al., 1989), there is a body of TAM research which has investigated ES (see, for example, Amoako-Gyampah & Salam, 2004; Hwang, 2005; Hernandez et al., 2008; Calisir et al., 2009). The widespread usage and acceptance of the TAM within the IS literature is indicated by Silva (2007), who suggests that is very unlikely that the usage of a particular type of technology cannot be predicted or explained by the TAM. Indeed, in a recent piece of work, King and He (2006) inferred through a meta-analysis of 88 published empirical TAM studies that this particular theoretical approach represents a powerful and valid research model which can have even wider applicability than it has thus far. A search of the academic literature from the period 2000 to 2011 indicates that the TAM is still used widely in empirical research worldwide, and, remarkably, its use has increased since the year 2008 (see Table 2).

Table 2. Number of empirical TAM studies since the year 2000

Year	No. of Studies
2000	2
2001	1
2002	-
2003	4
2004	6
2005	5
2006	9
2007	4
2008	14
2009	14
2010	11
2011 (until May)	6

According to Davis et al. (1989), the TAM examines the impact of external factors on internal beliefs, attitudes, and intentions to use a particular technology. The original version of the TAM is depicted in Figure 1. As can be seen, the model hypothesises that external variables affect perceived usefulness and perceived ease of use of a particular technology, which subsequently influence attitudes toward using the technology, behavioral intention to use the technology, and the actual use of the technology. Definitions of perceived usefulness and perceived ease of use have been formulated by Davis et al. (1989, p. 985) as follows: perceived usefulness "is the prospective user's subjective probability that using a specified application system will increase his or her job performance within an organisational context", and perceived ease of use "refers to the degree to which the prospective user expects the target system to be free of effort".

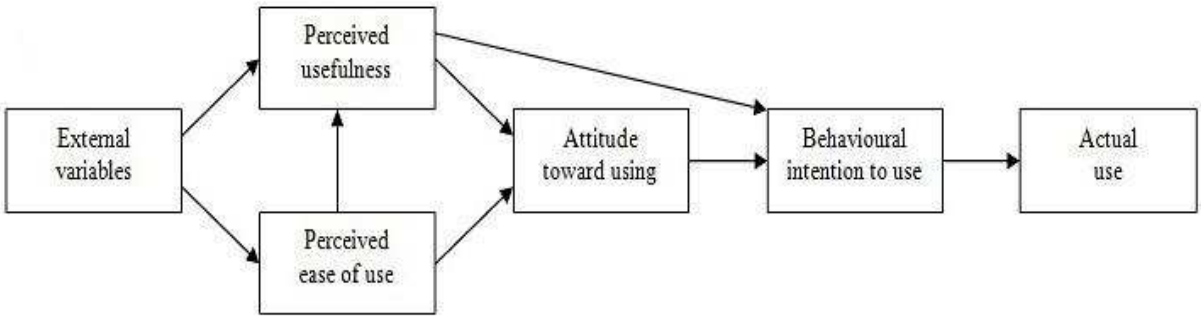

Figure 1. The Original TAM, Davis et al. (1989)

A further review of previous empirical research, which has employed the TAM, suggests that more useful explanations on the usage of a specific technology may be provided once the TAM is combined with other relevant appropriate theories. To date, the TAM has been 'bundled' and applied with

theories such as the concept of cognitive absorption (Saade and Bahli, 2005), the diffusion of innovations theory (Wu and Wang, 2005; Zhou, 2008), the expectancy disconfirmation theory (Roca et al., 2006), the fairness theory (Chiu et al., 2009), the five-factor model (Devaraj et al., 2008), the flow theory (Koufaris, 2002; Hsu and Lu, 2004; Hwang, 2005; Shin and Kim, 2008; Lu et al., 2009), the task technology fit model (Dishaw and Strong, 1999; Pagani, 2006) and the theory of planned behaviour (Lu et al., 2009; Aboelmaged, 2010). In terms of the proposed research, an integration of the TAM and flow theory has been adopted as the principle theoretical lens through which to investigate the phenomena under consideration. This approach is believed to lead to a more complete understanding of the impact that ES have on management accounting. Similar to the TAM, flow theory (also known as the psychology of optimal experience) has been used widely in empirical research to date. However, in comparison with the TAM which is focused on human usage of IS technologies, flow theory has a broader application, as it is focused on human involvement in an activity which does not necessarily involve usage of IS technologies. As a result, flow theory has generally had a wider applicability than the TAM given its potential for application in a number of disciplines beyond IS (e.g. arts and humanities, biology, psychology). Nevertheless, a search of the literature indicates that its application also lies in the IS discipline (see, for example, Finneran and Zhang, 2003; Pace, 2004; Pilke, 2004; Sharafi et al., 2006; Chen et al., 2008; Ho and Kuo, 2010; Joo et al., 2011). Like the TAM, the flow theory has also been employed in ES research, although to a lesser extent (see, for example, Hwang, 2005; Choi et al., 2007).

Flow theory is a concept that was proposed by Csikszentmihalyi (1975). Flow is defined as "the holistic sensation that people feel when they act with total involvement" (Csikszentmihalyi, 1975, p. 36). When people are in flow, they are deeply absorbed in an activity (Csikszentmihalyi, 1977, 1990). Csikszentmihalyi (1975) originally identified four flow constructs, namely control, attention, curiosity, and intrinsic interest. Since 1975, a number of flow variants have been proposed (see, for example, Ghani, 1995; Koufaris, 2002; Finneran and Zhang, 2003; Li and Browne, 2006). In recent research, Koufaris (2002) utilised three constructs, namely perceived enjoyment, concentration, and perceived control, in order to measure flow. Perceived enjoyment is defined as the extent to which "the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use" (Venkatesh, 2000, p. 351). Concentration is defined as the extent to which an individual focuses on the activity of using a specific system (Koufaris, 2002). Finally, perceived control refers to the degree to which an individual believes that he or she has the necessary resources, capability, and a sense of control to successfully support system use (Lu et al., 2009). Koufaris (2002) further hypothesises that the aforementioned flow constructs affect behavioral intention to use a specific system (see Figure 2).

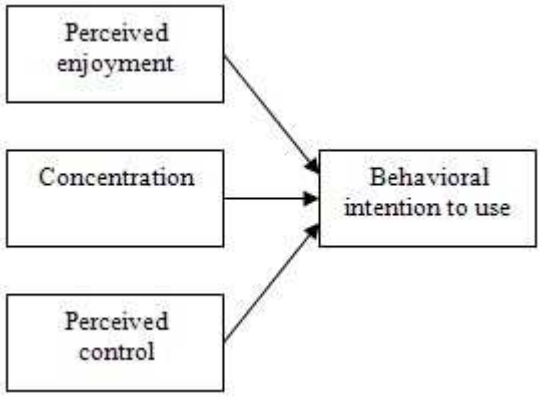

Figure 2. The Flow Theory, Koufaris (2002)

It is important to note that there is one key difference between the TAM and flow theory. The TAM is designed to model extrinsic motivation, while flow theory attempts to model intrinsic motivation.

Extrinsic motivation "refers to the desire to perform an activity because it is perceived to lead to distinct and valued outcomes", while intrinsic motivation "refers to the desire to engage in an activity for no other reason than the process of performing it" (Lu et al., 2009, p. 31). The majority of IS research to date has examined IS usage in various contexts by adopting theoretical approaches which model extrinsic motivation (e.g. the TAM). However, researchers have recently stressed that the role of intrinsic motivation is equally important in explaining IS usage (see, for example, Venkatesh, 1999; Hwang, 2005; Lu et al., 2009). Empirical research by Hwang (2005) adopted such an approach by combining the TAM and flow theory in order to investigate ERP systems adoption through a survey of ERP system users in a number of organisations. Hwang (2005) suggests that IS researchers should focus on informal control mechanisms, such as those represented by the TAM and flow theory, in order to investigate ES implementation issues more appropriately. Given that both extrinsic and intrinsic motivations are likely to have an impact on the extent of change in management accounting practice and in the management accountant's role resulting from ES implementations, the research model developed in this paper proposes to draw on both the TAM and flow theory. It is anticipated that a more informed understanding of the phenomena under consideration will be achieved by drawing on a multiple theoretical lenses such as that proposed.

4. THE RESEARCH MODEL

The proposed research model is illustrated in Figure 3. The model shows the independent, mediator and dependent variables and how these relate to ES. It should be noted that the 'attitude toward using' construct, which was used in the original TAM, has been excluded from the research model developed in this paper since previous empirical research has shown that this construct does not constitute a significant mediator variable (see, for example, Venkatesh and Davis, 1996; Venkatesh, 1999). Indeed, it can be seen in the two principle variants of the original TAM, known as TAM 2 and TAM 3 (see Venkatesh and Davis, 2000 and Venkatesh and Bala, 2008, respectively), that this construct is no longer used. At this point, it is also worth noting that the reason that one of these two updated versions of the TAM does not underpin the proposed research model is that both TAM 2 and TAM 3 propose a number of specified external variables, whereas our intention is to examine a number of external variables which have been identified on the basis of a comprehensive review of previous empirical research at the interface of ES and management accounting (see Vakalfotis et al., 2011). In this paper, we have adopted the main body of TAM 2 which represents the main tenets of the original TAM without the 'attitude toward using' construct. This approach is in line with other researchers who have adopted such an approach (see, for example, Horton et al., 2001; Yi and Hwang, 2003; Hwang, 2005; Devaraj et al., 2008; Song et al., 2009; Pai and Huang, 2010).

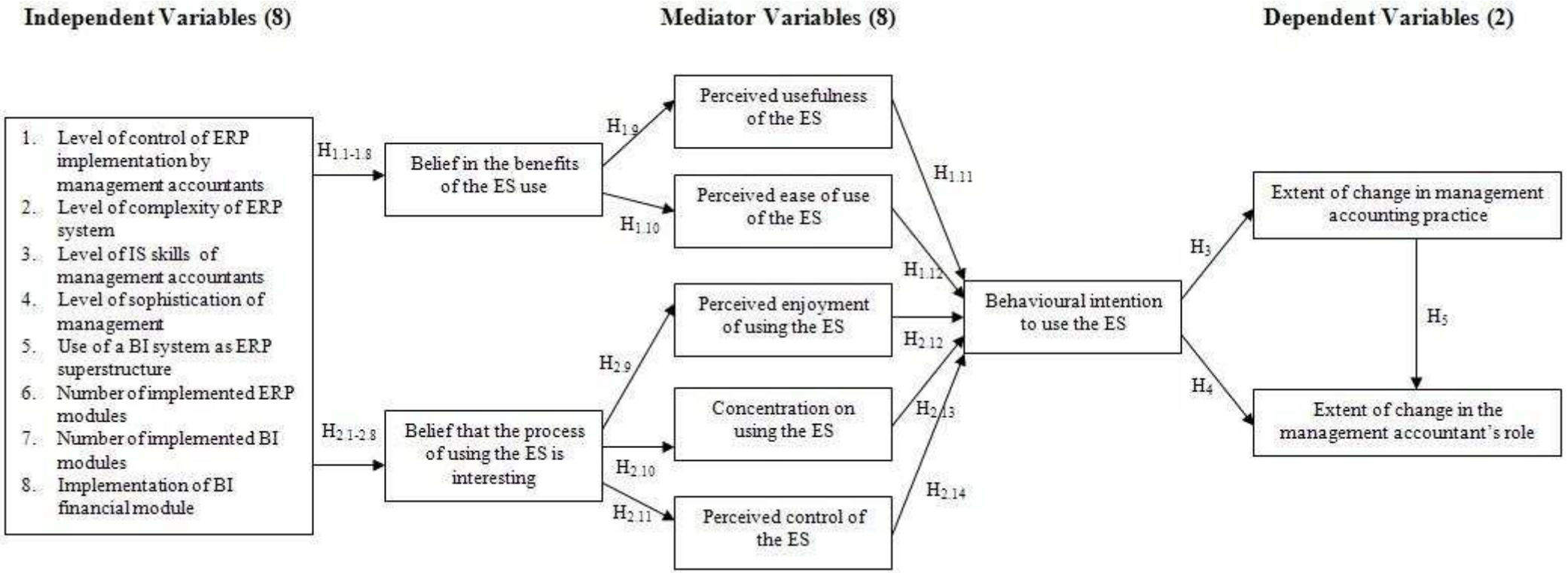

Figure 3. The Proposed Research Model

It should be noted that two supplementary mediator variables, namely 'belief in the benefits of the ES use' and 'belief that the process of using the ES is interesting', have been incorporated in the proposed research model in terms of the TAM and flow theory, respectively. The 'belief in the benefits of the ES use' construct, which has been adapted from the study of Amoako-Gyampah and Salam (2004), reflects (from the perspective of our study) the perception of the management accountant regarding the degree to which the ES can benefit/advance management accounting. Therefore, it represents an extrinsic motivation. The 'belief that the process of using the ES is interesting' construct is developed and proposed in this paper, and reflects the perception of the management accountant regarding the degree to which the process of using the ES is interesting. Therefore, it represents an intrinsic motivation. Finally, the dependent variable used in the original TAM, namely 'actual use', has been replaced by two dependent variables, namely 'extent of change in management accounting practice' and 'extent of change in the management accountant's role'. In the past, many researchers, employing the TAM, have replaced the original dependent variable with one or more alternative dependent variables (see, for example, Perez et al., 2004; Shih, 2004; McKechnie et al., 2006; Kim and Chang, 2007; Zhou, 2008; Chu and Chu, 2011).

A brief description of the model constructs is provided in Table 3 under the following three categories: independent variables, dependent variables, and mediator variables. The independent variable is the variable that is varied or manipulated and the dependent variable is the one that is affected by the changes in the value of the independent variable. Finally, the mediator variable is the variable that mediates the effect of the independent variable on the dependent variable.

Table 3. Brief descriptions of model constructs

Type of variables	**Variables and Descriptions**
Independent	*Level of control of ERP implementation by management accountants*: The degree to which the management accountant has exerted influence on ERP implementation.
	Level of complexity of ERP system: This variable has two dimensions. The first refers to the degree to which the management accountant finds the adaptation of his or her business to the ERP environment difficult. The second refers to the degree to which the management accountant finds the configuration of the ERP system so that it is capable of meeting business requirements difficult.
	Level of IS skills of management accountants: The degree to which the management accountant possesses the IS skills required to extract the benefits from the ES.
	Level of sophistication of management: The degree to which the management of the business intends to advance management accounting practice.
	Use of a BI system as ERP superstructure: Has a BI system been implemented as an extension to the ERP system?
	Number of implemented ERP modules: How many ERP modules have been implemented?
	Number of implemented BI modules: If a BI system has been implemented as ERP superstructure, then how many BI modules have been implemented?
	Implementation of BI financial module: If a BI system has been implemented as ERP superstructure, then has the BI financial module been implemented?
Dependent	*Extent of change in management accounting practice*: the degree to which management accounting practice has been advanced as a result of ES implementation.
	Extent of change in the management accountant's role: the degree to which the role of the management accountant has been advanced as a result of ES implementation.
Mediator	*Belief in the benefits of the ES use*: the degree to which the management accountant believes that the ES can benefit management accounting.

	Perceived usefulness of the ES: the degree to which the management accountant believes that the ES will help increase his or her job performance.
	Perceived ease of use of the ES: the degree to which the management accountant believes that the ES will ease his or her job.
	Belief that the process of using the ES is interesting: the degree to which the management accountant believes that the process of using the ES is interesting.
	Perceived enjoyment of using the ES: the degree to which the management accountant believes that the use of the ES is enjoyable in its own right, aside from any performance consequences resulting from it.
	Concentration on using the ES: the degree to which the management accountant focuses on the use of the ES.
	Perceived control of the ES: the degree to which the management accountant believes that he or she has the necessary resources, capability, and a sense of control to successfully support system use.
	Behavioural intention to use the ES: the degree to which the management accountant has formulated conscious plans to use the ES in order to advance management accounting practices.

5. THE RESEARCH HYPOTHESES

5.1. Relations between the Independent and the Mediator Variables

In the case study firm examined by Caglio (2003), the resulting changes of ERP implementation primarily favored the accountants because the latter played the most influential role in all decisions around the ERP implementation. This finding provides some evidence that the more involved the management accountant is in the ERP implementation, the more significant the changes in management accounting which will result from the implementation. Indeed, the case studies conducted by Grabski et al. (2009) suggest that the greater the involvement of management accountants in the ERP implementation, the greater the extent of change in their role resulting from it. Moreover, the antagonism between accounting and production personnel, as described in the study of Sayed (2006), regarding who should take control of the ERP implementation indicates that the benefits which can be derived from an ERP system will depend on who exerts influence on it and how strong this influence is. Furthermore, when the management accountant participates in ERP implementation, he or she should become more familiar with the ERP system, and, in the long run, the process of using the system should become more interesting to him or her. Thus, it can be hypothesised that the greater the degree to which the management accountant has exerted influence in ERP implementation, the greater the degree to which the management accountant believes that the ES can benefit management accounting, and therefore the greater the degree to which the management accountant believes that the process of using the ES is interesting.

In a number of case studies (see Granlund and Malmi, 2002; Dechow and Mouritsen, 2005; Quattrone and Hopper, 2005; Granlund, 2007; Kholeif et al., 2007; Jack and Kholeif, 2008) where ERP systems were considered by the interviewees to be very complex IS, the companies experienced only minor changes in management accounting post ERP implementation. Although there were endeavors to advance management accounting, for example, by utilising sophisticated accounting techniques, such attempts were largely unsuccessful because of the complexity of the ERP system implemented. Developing this argument, if an ERP system is very complex, then the process of using the system will not be interesting to the user (the management accountant in our case), as a number of problems may arise during its use (see, for example, Kholeif et al., 2007; Jack and Kholeif, 2008; Grabski et al., 2009; Sangster et al., 2009). For example, in the case study of Jack and Kholeif (2008), the ERP

system was unable to meet organisational needs, and, as a result, it ended up being a typical accounting information system whose usage was not interesting to management accountants. Thus, it can be hypothesised that the more complex an ERP system is, the less likely the management accountant believes that the ES can benefit management accounting, and the less likely the management accountant believes that the process of using the ES is interesting.

In the organisation studied by Caglio (2003), post ERP implementation management accountants focused not only on the analysis of the information generated from the ERP system but also on the management and development of the system. Sayed (2006) found that with the acquisition of a high level of IS skills, management accountants managed to represent themselves as experts in achieving the benefits of an ERP implementation. It is well documented that IS skills are amongst the most important competencies that management accountants should possess in an ES environment (see, for example, Sayed, 2006; Grabski et al., 2009; Sangster et al., 2009). Furthermore, when the management accountant possesses a high level of IS skills, he or she should feel more confident toward the use of the system, and this should render the process of using the ES more interesting to him/her. Thus, it can be hypothesised that the greater the degree to which the management accountant possesses IS skills required to extract the benefits from the ES, the greater the degree to which the management accountant believes that the ES can benefit management accounting, and the greater the degree to which the management accountant believes that the process of using the ES is interesting.

Rom and Rohde (2006) argue that the more sophisticated the managers of the business are, the greater their willingness to advance management accounting. For example, if the adoption of sophisticated accounting techniques is not among the goals of managers, then such techniques will not be adopted even if the ES can support their utilisation. Subsequently, this could make the process of using the ES less interesting to the management accountant. Thus, it can be hypothesised that the greater the degree to which the management of the business intends to advance management accounting, the greater the degree to which the management accountant believes that the ES can benefit management accounting, and the greater the degree to which the management accountant believes that the process of using the ES is interesting.

Rom and Rohde (2006) suggest that when a BI system is implemented as ERP superstructure, then the ES can further improve data collection and facilitate and advance reporting, analysis, and budgeting tasks. Furthermore, Rom and Rohde (2006) indicate that ES composed of both ERP and BI systems appear to have the capacity to support the utilisation of sophisticated accounting techniques. As a result, in an ERP integrated BI environment, we would argue that the management accountant will be involved with more interesting tasks such as advanced information analysis and utilisation of sophisticated accounting techniques. Thus, it can be hypothesised that when a BI system is implemented as an extension to an ERP system, then the degree to which the management accountant believes that the ES can benefit management accounting and that the process of using the ES is interesting is greater.

As the IS literature suggests, the more comprehensive an ERP system is, the greater the number of benefits that can be derived from its implementation. This occurs because optimal information integration can be achieved only if all or almost all ERP modules have been implemented. Indeed, in the firm studied by Caglio (2003), a number of benefits with regard to management accounting were derived from the ERP system, not only because the accountants had primary control over the implementation but also because all ERP modules were implemented. The implementation of a whole ERP system should also render the use of the system to be more interesting to the management accountant, given that the latter deals with information collection, reporting, and analysis tasks. Thus, it can be hypothesised that the greater the number of implemented ERP modules, the greater the degree to which the management accountant believes that the ES can benefit management accounting, and the greater the degree to which the management accountant believes that the process of using the ES is interesting.

Similar to ERP systems, BI systems also comprise a number of modules, namely financial analytics, sales analytics, marketing analytics, price analytics, procurement analytics, spend analytics, human resource analytics, order management analytics, and others (see, for example, Oracle Business Intelligence, www.oracle.com). Accordingly, the greater the number of the implemented BI modules, better quality information is likely to result. Thus, for the same reasons noted above, it can be hypothesised that the greater the number of implemented BI modules in an ERP environment, the greater the degree to which the management accountant believes that ES can benefit management accounting, and the greater the degree to which the management accountant believes that the process of using the ES is interesting.

A BI financial module typically embodies all these applications or components that can facilitate advances in management accounting (see, for example, IBM Cognos Business Intelligence, www.ibm.com; Oracle Business Intelligence, www.oracle.com; SAP Business Intelligence, www.sap.com). If a BI system is implemented as ERP superstructure, but the BI financial module is excluded from the implementation, then it is more unlikely that management accounting will be influenced by the implementation of the BI system. Thus, it can be hypothesised that when a BI financial module is implemented in an ERP environment, then the degree to which the management accountant believes that the ES can benefit management accounting and that the process of using the ES is interesting is greater.

Based on the above discussion, the hypotheses listed in Table 4 have been formulated.

Table 4. Hypotheses in terms of the relations between the independent and the mediator variables

Number	Hypothesis
1.1	Level of control of ERP implementation by management accountants is positively related to belief in the benefits of the ES use.
2.1	Level of control of ERP implementation by management accountants is positively related to belief that the process of using the ES is interesting.
1.2	Level of complexity of ERP system is negatively related to belief in the benefits of the ES use.
2.2	Level of complexity of ERP system is negatively related to belief that the process of using the ES is interesting.
1.3	Level of IS skills of management accountants is positively related to belief in the benefits of the ES use.
2.3	Level of IS skills of management accountants is positively related to belief that the process of using the ES is interesting.
1.4	Level of sophistication of management is positively related to belief in the benefits of the ES use.
2.4	Level of sophistication of management is positively related to belief that the process of using the ES is interesting.
1.5	Use of a BI system as ERP superstructure is positively related to belief in the benefits of the ES use.
2.5	Use of a BI system as ERP superstructure is positively related to belief that the process of using the ES is interesting.
1.6	Number of implemented ERP modules is positively related to belief in the benefits of the ES use.
2.6	Number of implemented ERP modules is positively related to belief that the process of using the ES is interesting.
1.7	Number of implemented BI modules is positively related to belief in the benefits of the

	ES use.
2.7	Number of implemented BI modules is positively related to belief that the process of using the ES is interesting.
1.8	Implementation of BI financial module is positively related to belief in the benefits of the ES use.
2.8	Implementation of BI financial module is positively related to belief that the process of using the ES is interesting.

5.2. Relations among the Mediator Variables

Amoako-Gyampah and Salam (2004) found a strong positive relationship between ERP users' belief in the benefits of ERP system and ERP users' perceived usefulness of ERP system. They also found a positive, but less strong relationship between ERP users' belief in the benefits of ERP system and ERP users' perceived ease of use of ERP system. Furthermore, Amoako-Gyampah and Salam (2004) found that the 'belief in the benefits of ERP system' variable was affected by two external variables, namely project communication related to ERP system and training on ERP system. In terms of the present study, 'management accountants' belief in the benefits of the ES use' is argued to be affected by eight external variables. In a similar fashion to the study of Amoako-Gyampah and Salam (2004), it can be hypothesised that the greater the degree to which the management accountant believes that the ES can benefit management accounting, the greater the degree to which the management accountant believes that the ES will help increase his or her job performance, and the greater the degree to which the management accountant believes that the ES will ease his or her job. In addition, if the management accountant believes that the ES has the potential to increase his or her job performance and ease his or her job, then it is more likely that the management accountant will develop appropriate plans and undertake the necessary actions in order to advance management accounting through the ES.

In terms of flow theory, it is argued that the 'belief that the process of using the ES is interesting' construct is also affected by eight external variables. It is important to note that this construct has been introduced in order to simplify the model proposed in this paper. Thus, instead of proposing a total of twenty four relations between the independent and the mediator variables, we are now proposing eleven relations whilst maintaining the same logic. The naming of this construct (i.e. belief that the process of using the ES is interesting) was inspired by the fact that flow theory models an intrinsic motivation which "refers to the desire to engage in an activity for no other reason than the process of performing it" (Lu et al., 2009, p. 31). In terms of flow theory, it can by hypothesised that the greater the degree to which the management accountant believes that the process of using the ES is interesting, the greater the degree to which the management accountant believes that the use of the ES is enjoyable in its own right, irrespective of any performance consequences resulting from it, the greater the degree to which he or she focuses on the use of the ES, and the greater the degree to which he or she believes that the necessary resources, capability, and a sense of control exists so that he or she can support system use. Subsequently, if the management accountant believes that the use of the ES is enjoyable, if he or she has focused on the use of the ES, and if he or she believes that the necessary resources, capability and a sense of control exist so that he or she can support system use, then it is more likely that the management accountant will develop appropriate plans and undertake the necessary actions in order to advance management accounting through the ES.

The foregoing discussion leads to the hypotheses listed in Table 5.

Table 5. Hypotheses in terms of the relations among the mediator variables

Number	Hypothesis
1.9	Belief in the benefits of the ES use is positively related to perceived usefulness of the ES.
1.10	Belief in the benefits of the ES use is positively related to perceived ease of use of the ES.
1.11	Perceived usefulness of ERP system is positively related to behavioral intention to use the ES.
1.12	Perceived ease of use of ERP system is positively related to behavioral intention to use the ES.
2.9	Belief that the process of using the ES is interesting is positively related to perceived enjoyment of using the ES.
2.10	Belief that the process of using the ES is interesting is positively related to concentration on using the ES.
2.11	Belief that the process of using the ES is interesting is positively related to perceived control of the ES.
2.12	Perceived enjoyment of using the ES is positively related to behavioral intention to use the ES.
2.13	Concentration on using the ES is positively related to behavioral intention to use the ES.
2.14	Perceived control of the ES is positively related to behavioral intention to use the ES.

5.3. Relations between the Mediator and the Dependent Variables

When the management accountant has formulated conscious plans to use the ES in order to advance management accounting practices, then it is more likely that management accounting practice and the role of the management accountant within the organisation will be advanced as a result of ES implementation. In situations where the management accountant has formulated plans, but his or her plans have not been successful, this may indicate that ERP and BI systems are not appropriate information systems in terms of advancing management accounting practices. Such a finding would be in line with that of Dechow and Mouritsen (2005) who reported that ERP systems were not effective tools in terms of management accounting. Finally, when management accounting practice is advanced, then the role of the management accountant will also be advanced automatically, because the latter is then providing more valuable information to decision makers.

Based on the above discussion, the hypotheses outlined in Table 6 have been formulated.

Table 6. Hypotheses in terms of the relations between the mediator and dependent variables

Number	Hypothesis
3	Behavioural intention to use the ES is positively related to extent of change in management accounting practice.
4	Behavioural intention to use the ES is positively related to extent of change in the management accountant's role.
5	Extent of change in management accounting practice is positively related to extent of change in the management accountant's role.

6. CONCLUSION

The purpose of this study was to develop and propose for empirical testing a conceptual model of causal relationships that can help academics and practitioners to better understand the relationship between ES and management accounting. Two widely recognised theories from the IS research literature have been drawn upon in the development of the conceptual model, namely the TAM and flow theory. Furthermore, the conceptual model was enriched with a number of important external variables which have been identified by Vakalfotis et al. (2011) as a result of an extensive literature

review, namely ‘level of control of ERP implementation by management accountants’, ‘level of complexity of ERP system’, ‘level of IS skills of management accountants’, ‘level of sophistication of management’, ‘use of a BI system as ERP superstructure’, ‘number of implemented ERP modules’, ‘number of implemented BI modules’ and ‘implementation of BI financial module’. Insights into these variables and the influence they exert on the extent of change in management accounting practice and in the role of the management accountant resulting from ES implementations have primarily been gained thus far from case study research. As a result, well-grounded generalisations among organisations have been difficult. It is anticipated that empirical testing of the proposed model in a large scale survey research will provide more informed answers to the research questions outlined at the beginning of this paper. As a result, managers and management accountants will be better informed of whether, how, and, to what extent, ERP and BI systems can facilitate their endeavors to improve business control and planning by advancing management accounting practice. The findings of such a study would also provide more informed answers as to whether, how, and, to what extent, ERP and BI can advance the role of the management accountant. It is worth noting that future empirical research, which will test the proposed research model, may also consider the presence of relevant control variables (e.g. years that the ERP systems has been operational) which might effect the dependent variables. For example, the value of the abovementioned variable could be defined as ‘above two years’; that is to say that evidence will be collected only from firms which have operated in an ERP environment for more than two years. Since ERP systems often need time to ‘bed in’ (Adhikari et al., 2004), the majority of benefits are expected to be derived from these systems when they are in their maturity phase.

In conclusion, within the area of ES and management accounting, recent calls have been made (see, for example, Sutton, 2006; Granlund, 2011) that there is a greater need to adopt and expand the use of theoretical approaches in order to better understand ES-related changes in management accounting. Additionally, Arnold (2006) argued that researchers should undertake survey research of large scale populations in order to further explore the useful insights which have been obtained from case study research, so that safe generalisations can be made. In this paper, the researchers have responded to these calls by developing a research model which is based on two theories which have been used in previous quantitative ES research, but not in ES-management accounting research. Further work by the researchers will aim to develop an understanding of how to measure the constructs developed here.

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